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EXAMINER	
GUILL, RUSSELL L	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/608,935	Applicant(s) RASMUSSEN ET AL.	
	Examiner Russ Guill	Art Unit 2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 February 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 July 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. This Office Action is in response to an Amendment filed February 15, 2008. Claims 1 – 4 have been examined. Claims 1 - 4 have been rejected.

Response to Remarks

2. Regarding claim 4 objected to for minor informalities:

a. Applicant's arguments and amendments to the claims overcome the objection.

3. Regarding claims 1 - 4 rejected under 35 USC § 103:

a. Applicant's arguments have been fully considered, but are not persuasive, as described in the following. Accordingly, the rejections are maintained.

b. The Applicant argues:

c. Independent claim 1 is directed to a method of simulating advection of a plurality of elements through space. The method includes generating a plurality of 2D grids in which each 2D grid is independent and has a plurality of grid points. Movement information is associated with each 2D grid point. The movement information associated with the 2D grid points changes over a time period that includes discrete intervals. A region of 3D space is defined using the 2D grids. The method also includes advecting the plurality of elements through the region of 3D space using the movement information associated with the 2D grids and displaying the simulated advection of the plurality of elements.

d. Referring to the subject action, the Examiner appears to concede that Harris does not specifically teach each feature of independent claim 1. In particular, the Examiner appears to concede that Harris is not understood to teach "advecting the plurality of elements through the region of 3D space using the movement information associated

with the 2D grids." The Examiner appears to turn to Gamito for the teaching this feature. Referring to page 4, the subject action reads:

i. 1. Harris does not specifically teach:

ii. Advecting the plurality of elements through the region of 3£) space using the movement information associated with the 2D grids.

iii. Displaying the simulated advection of the plurality of elements.

iv. Gamito appears to teach:

v. Advecting the plurality of elements through the region of 2D space using the movement information associated with the 2D grids (fifth page, section 4 A Particle-Grid Model, and figure I).

vi. Displaying the simulated advection of the plurality of elements (last page, colour plate Turbulent smoke stream).

e. The Applicants notice that the Examiner has crossed out particular terms in one instance of reciting claim 1 (item m.) and added a term (i.e., the first occurrence of "2D") in a second rendition of claim 1 (item p.). In particular, it is the Applicants understanding that the Examiner appears to suggest that the Gamito teaches advecting the plurality of elements through a region of 2D space by using movement information associated with 2D grids. It is the Applicants further understanding that the Examiner combines Harris (with Gamito), since Harris mentions 3D space.

i. The Examiner respectfully replies:

ii. The Applicant is correct.

f. The Applicant argues:

g. However, Applicants assert that Gamito describes an algorithm for two dimensions and does not describe a methodology that is transferable to three dimensions. In particular, regarding the two dimensional algorithm, Gamito reads:

i. This article presents a simple, fast and stable method for the animation and visualization of turbulent gaseous fluids in two dimensions. We draw on well known methods from computational fluid dynamics to model the fluid using vorticity and velocity fields...(Abstract, emphasis added)

h. In regards to using the Gamito two dimensional algorithm in a three dimensional space, the reference reads:

i. At present, the method is only applicable for two dimensional flow fields. It has however, very low computational costs and can handle systems with large number of particles...(unnumbered page 2; last paragraph of section "1 Introduction"; emphasis added)

i. The reference also reads:

i. Many improvements can be made to the algorithm. The first and most obvious one is the extension to a fully three-dimensional vorticity model...(unnumbered page 10, first paragraph of section "8 Future Developments")

ii. During the evolution of the flow, vortex filaments tend to stretch and become highly entangled in each other as the result of the vortex stretching mechanism.... Such a three-dimensional vorticity algorithm will be harder to implement and will certainly be much slower. It is questionable whether such an algorithm can be useful for computer animation purposes. (unnumbered page 10, second paragraph of section "8 Future Developments"; emphasis added)

j. Thus, while Harris provides a method for visualizing gaseous fluids in two dimensions, the reference does not provide a three dimensional algorithm. Furthermore, the reference states that the described algorithm "is only applicable for two dimensional flow fields" and for producing a three-dimensional algorithm, the reference can only speculate that such an algorithm would "be harder to implement" and "questionable whether such an algorithm can be useful." As such, the Applicants assert that the reference teaches away from a method that includes advecting a plurality of elements through a region of 3D space using movement information associated with 2D grids, as

required by independent claim 1. For at least this reason, amended independent claim 1 is believed to be patentable.

i. The Examiner respectfully replies:

ii. The algorithm of Gamito appears to be transferable to 3D space because, as recited above, Gamito recites, "Many improvements can be made to the algorithm. The first and most obvious one is the extension to a fully three-dimensional vorticity model", which would reasonably suggest to the ordinary artisan to extend the algorithm to 3D. Gamito recites that "At present, the method is only applicable for two dimensional flow fields", but as discussed above, Gamito suggests that the algorithm be extended to 3D.

iii. Further, Gamito does not appear to teach away from a method that includes advecting a plurality of elements through a region of 3D space using movement information associated with 2D grids. In addition to the suggestion discussed above to extend the algorithm to 3D, Gamito recites on page 11, section 9 Conclusions, "Three-dimensional algorithms are possible and several implementations already exist." Thus, the method appears to already have been extended to 3D.

iv. While Gamito speculates that a three-dimensional algorithm "will be harder to implement", the statement appears to simply state the obvious that a 3D algorithm is harder to design than a 2D algorithm. Gamito also speculates, "it is questionable whether such an algorithm can be useful for computer animation purposes", but this appears to be merely intellectual speculation about a possible extension to the algorithm.

v. Further, an important benefit of the invention of Harris is that it overcomes the issues associated with extending Gamito's 2D algorithm to 3D by using 2D slices to represent a 3D volume, which allows a faster and

easier implementation, and the ordinary artisan would have recognized this. A person of ordinary skill is also a person of ordinary creativity, not an automaton. *KSR*, 127 S. Ct. at 1742. The combination of familiar elements according to known methods is likely obvious when the combination does no more than yield predictable results. *KSR*, 127 S. Ct. at 1739.

vi. Further, Harris provides several motivations to use the teachings of Harris with the teachings of Gamito, such as, providing a simple, fast and flexible method for the visual simulation of a variety of dynamic systems and phenomena.

vii. Accordingly, the rejections are maintained.

k. The Applicant argues:

l. Independent claim 2 and amended independent claim 4 include limitations that are similar to those described above with respect to claim 1. As such, independent claims 2 and 4 are also believed to be allowable for at least the same reasons noted above.

m. The dependent claim 3 partakes of the novelty of it's parent claim and, although it is believed that the dependent claim defines a separate patentable feature, for this reason the dependent claim is not discussed here in detail.

i. The Examiner respectfully replies:

ii. Since claims 2 and 4 are argued for the same reasons as claim 1, the rejections are also maintained as discussed for claim 1.

iii. Since the rejection of claim 2 is maintained, the rejection of claim 3 is also maintained.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. **Claims 1 - 4** are rejected under 35 U.S.C. 103(a) as being unpatentable over Harris (Mark J. Harris et al., "Physically-Based Visual Simulation on Graphics Hardware", September 2002, Proceedings of the ACM SIGGRAPH/EUROGRAPHICS Conference on Graphics Hardware, pages 109 – 118 and 160) in view of Gamito (Manuel gamito et al., "Two-dimensional simulation of gaseous phenomena using vortex particles", 1995, Computer Animation and Simulation '95, Springer-Verlag, 14 unnumbered pages).

    a. The art of Gamito is directed to animation and visualization of turbulent gaseous flows in two dimensions (*first page, abstract*).

    b. The art of Harris is directed to visual simulation of dynamic phenomena such as convection and cloud formation (*page 109, abstract, and page 112, left-side column, first paragraph, "convection and cloud formation simulations"*).

c. The motivation to use the art of Gamito with the art of Harris would have been the benefit recited in Gamito that the system has very low computational costs and can handle systems with large numbers of particles (*second page, second paragraph, which is the last paragraph of section 1*). Further benefits recited are that the algorithm is fast and easy to implement (*section 9 Conclusions, fourth and fifth paragraphs*).

d. Regarding **claim 1**:

e. Harris appears to teach:

f. Generating a plurality of 2D grids, each 2D grid being independent and having a plurality of grid points (*page 114, left-side column, second paragraph, "we implement 3D simulations using a collection of 2D slices to represent the 3D volume"*).

g. Associating movement information with each 2D grid point (*pages 111 - 112, section 3.3.2 Directional Forces, "The buoyancy operator uses temperature state T to compute a buoyant velocity at a node", and page 114, section 4.2 Convection; it would have been obvious that velocity was movement information*).

h. Changing the movement information associated with the 2D grid points over a time period that includes discrete intervals (*page 112, section 3.5 Implementing the CML Operations, first sentence; it would have been obvious that an iteration is a time step*).

i. Defining a region of 3D space using the 2D grids (*page 114, left-side column, second paragraph, "we implement 3D simulations using a collection of 2D slices to represent the 3D volume"*).

j. ~~Advecting the plurality of elements through the region of~~ 3D space ~~using the movement information associated with the 2D grids~~ (*page 114, left-side column, second paragraph, "we implement 3D simulations using a collection of 2D slices to represent the 3D volume"*).

k. Displaying the simulated advection of the plurality of elements ().

l. Harris does not specifically teach:

m. Advecting the plurality of elements through the region of ~~3D~~ space using the movement information associated with the 2D grids.

n. Displaying the simulated advection of the plurality of elements.

o. Gamito appears to teach:

p. Advecting the plurality of elements through the region of *2D* space using the movement information associated with the 2D grids (*fifth page, section 4 A Particle-Grid Model, and figure 1*).

q. Displaying the simulated advection of the plurality of elements (*last page, colour plate 1, Turbulent smoke stream*).

r. Therefore, as discussed above, it would have been obvious to the ordinary artisan at the time of invention to use the art of Gamito with the art of Harris to produce the claimed invention.

s. Regarding **claim 2**:

t. Harris appears to teach:

u. Generating a plurality of 2D grids, each 2D grid being independent and having a plurality of grid points, each grid point having movement information (*page 114, left-side column, second paragraph, "we implement 3D simulations using a collection of 2D slices to represent the 3D volume", and pages 111 - 112, section 3.3.2 Directional Forces, "The buoyancy operator uses temperature state T to compute a buoyant velocity at a node", and page 114, section 4.2 Convection; please note that velocity is movement information*);

v. Defining a region of 3D space using the 2D grids (*page 114, left-side column, second paragraph, "we implement 3D simulations using a collection of 2D slices to represent the 3D volume"*).

w. ~~Generating a plurality of elements in the region of~~ 3D space, ~~each element having a location ;~~

x. ~~For each element, determining movement information for an element based on the location of the element in the~~ region of 3D space, ~~wherein the determination includes:~~

y. ~~Identifying points on the 2D grids that lie on both sides of the element at the location in the~~ region of 3D space;

z. Determining movement information at the points on the 2D grids (*pages 111 - 112, section 3.3.2 Directional Forces, "The buoyancy operator uses temperature state T to compute a buoyant velocity at a*

node", and page 114, section 4.2 Convection; it would have been obvious that velocity was movement information);

aa. ~~Interpolating between the movement information at the points on the 2D grids to determine element movement information for the element at the location in~~ 3D space ~~to simulate advecting of the element~~;

bb. Harris does not specifically teach:

cc. Generating a plurality of elements in the region of ~~3D~~ space, each element having a location;

dd. For each element, determining movement information for an element based on the location of the element in ~~the region of 3D space~~, wherein the determination includes:

ee. Identifying points on the 2D grids that lie on both sides of the element at the location in ~~the region of 3D space~~;

ff. Interpolating between the movement information at the points on the 2D grids to determine element movement information for the element at the location in 3D space to simulate advecting of the element;

gg. Displaying the advecting of the simulated elements;

hh. Gamito appears to teach:

ii. Generating a plurality of elements in the region of ~~3D~~ space, each element having a location (*fifth page, section 4 A Particle-Grid Model, and figure 1*);

jj. For each element, determining movement information for an element based on the location of the element in *2D space* ~~the region of 3D space~~, wherein the determination includes:

kk. Identifying points on the 2D grids that lie on both sides of the element at the location in *2D space* ~~the region of 3D space~~ (*fifth page, section 4 A Particle-Grid Model, and figure 1*);

ll. Interpolating between the movement information at the points on the 2D grids to determine element movement information for the element at the location in *2D* space to simulate advecting of the element (*fifth page, section 4 A Particle-Grid Model, and figure 1*);

mm. Displaying the advecting of the simulated elements (*last page, colour plate 1, Turbulent smoke stream*).

nn. Regarding **claim 3**:

oo. Harris appears to teach:

pp. The movement information includes a 2D vector (*page 114, section 4.2 Convection; it would have been obvious that velocity was a vector*);

qq. Regarding **claim 4**:

rr. Harris appears to teach:

ss. A computer to generate a plurality of 2D grids, each 2D grid being independent and having a plurality of grid points, each 2D grid point is associated with movement information (*page 114, left-side column, second paragraph, "we implement 3D simulations using a collection of 2D slices to represent the 3D volume", and pages 111 - 112, section 3.3.2 Directional Forces, "The buoyancy operator uses temperature state T to compute a buoyant velocity at a node", and page 114, section 4.2 Convection; please note that velocity is movement information*);

tt. Wherein the movement information associated with the 2D grid points of the 2D grids changes over a time period that includes discrete intervals (*pages 111 - 112, section 3.3.2 Directional Forces, "The buoyancy operator uses temperature state T to compute a buoyant velocity at a node", and page 114, section 4.2 Convection; it would have been obvious that velocity was movement information; and page 112, section 3.5 Implementing the CML Operations, first sentence; it would have been obvious that an iteration is a time step*);

uu. The computer also defines a region of 3D space using the 2D grids, ~~advects the plurality of elements through the region of~~ 3D space ~~using the movement information associated with the 2D grids and displays the simulated advection of the plurality of elements~~;

vv. Harris does not specifically teach:

ww. ~~The computer also defines a region of 3D space using the 2D grids~~, advects the plurality of elements through the region of *2D* space

using the movement information associated with the 2D grids (*fifth page, section 4 A Particle-Grid Model, and figure 1*) and displays the simulated advection of the plurality of elements (*last page, colour plate 1, Turbulent smoke stream*).

7. **Examiner's Note:** Examiner has cited particular columns and line numbers in the references applied to the claims above for the convenience of the applicant. Although the specified citations are representative of the teachings of the art and are applied to specific limitations within the individual claim, other passages and figures may apply as well. It is respectfully requested from the Applicant in preparing responses, to fully consider the references in their entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner. The entire reference is considered to provide disclosure relating to the claimed invention.

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

9. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Russ Guill whose telephone number is 571-272-7955. The examiner can normally be reached on Monday - Friday 9:30 AM - 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Rodriguez can be reached on 571-272-3753. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Any inquiry of a general nature or relating to the status of this application should be directed to the TC2100 Group Receptionist: 571-272-2100.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Russ Guill

Examiner
Art Unit 2123

RG

/Paul L Rodriguez/
Supervisory Patent Examiner,
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